NATIONAL RADIO ASTRONOMY OBSERVATORY
Green Bank, West Virginia

Electronics Division Internal Report No. 31

DIGITAL OUTPUT UNIT FOR THE LUNAR OCCULTATION RECEIVERS

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JUNE 1964

NUMBER OF COPIES: 75

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General

The outputs of the three lunar occultation receivers (at frequencies of 234, 256 and 405 MHz) are to be recorded on magnetic tape. The digital outputs from the three voltage-to-frequency converters are passed to the unit described here. This unit puts the data in a form suitable for recording on magnetic tape, via the new NRAO scanner.

Description of Unit

The output of each VFC goes to its own counter. The outputs of the counters are recorded on magnetic tape every even 0.1 second (i.e., every 0.2 second). Every odd 0.1 second, time is recorded, to the nearest 0.1 second. The receiver data occupies one word (i.e., six characters) on the tape, two characters for each receiver. Only eleven of the twelve binary bits per receiver are used, the most significant bit being left blank. If 2^{10} (rather than 2^{11}) is an acceptable receiver output maximum, the second most significant digit may be used as an "overflow indicator", since it remains "set" once triggered until the whole counter is reset. Initially this will be the mode of operation of the unit.

The time word is in BCD, and contains tens and units of hours, tens and units of minutes, and tens, units and tenths of seconds. The format for a time word is standard for NRAO, and is shown in Figure I.

At the beginning of each block, the first standard identification data (SID_B) is recorded, and followed by an inter-record gap (IRG). After this IRG, and immediately before recording the first time or data block, two further words are recorded automatically — a Fortran word (ignored if Fortran is not used in the computer program) and a record identification word. These two words are recorded between all IRG's and data (or time) words. When the unit is switched off an IRG is automatically recorded between the last data word (or time word) and the end-of-record SID (SID_E).

Since the capacity of the fast memory in the computer is limited, IRG's are provided at 1/4, 1/2 or 1 minute intervals, as selected, to permit the transfer of information from the fast memory, to a larger, slower memory. All such IRG's will be followed automatically by the two identification words when further data (or time) words follow. All such IRG's necessitate the loss of one word of data and two words of time.

A typical magnetic tape record is shown in Figure II.

Thirty-three storage bits are used, the first (most significant) bit of the first, third and fifth character of every word recorded from this unit being held at zero. A typical bit storage unit is shown in Figure III.

Time is taken from the BCD outputs of the NRAO sidereal clock. At a later date, the data may be derived from the NRAO solar clock.

SID information contains record name or code, date, time, telescope position and frequency. Other required parameters may be recorded by using special inputs to the scanner.

Details of Logic Operations

All voltages are either 0 V or -6 V. With the "Set-Stop-Start" switch at "Set", a pulse sets the "Stop-Start" gate in the correct position for operation, once the power supplies have been connected.

Switching to "Start" sets a level which permits the next positive-going T_1 level to send a 20 μsec "correct time" (CT) pulse to the scanner. This puts SID_B data on tape. After approximately 1/2 sec, and without further signal from the unit, the scanner sends an "IRG complete" pulse (E-IR). Simultaneously the E-IR pulse will open the gate for "start scan" (SS) pulses.

SS is generated alternately by $T_{0.1}$ and $\overline{T}_{0.1}$, voltages which change in the opposite sense every 0.1 seconds. SS is delayed so that a "clear register" pulse may have time to operate and be removed (20 μsec). Counter data is passed to the registers and the counters cleared, both by the same pulse. The "clear-set" sequence places data (from the three counters) and time in the registers on alternate 0.1 seconds. At

the end of any scan, when the content of the registers has been placed on magnetic tape, the scanner sends a "scan complete" (SC) pulse to the unit. Each word takes 15 ms to scan, which leaves ample time until the next SS. This sequence of recording will continue until a "record IRG" (R-IR) pulse occurs. This will have been generated by (a) switching the unit off, or (b) the selected time since the last IRG having elapsed. In case (a) the R-IR pulse from the scanner blocks all SS pulses to the scanner until the E-IR pulse arrives, whereupon the E-IR pulse opens a gate to permit the next SS pulse to generate a second CT pulse for the scanner. This second CT pulse switched off the unit and instructs the scanner to record SID_E before stopping. In case (b) the R-IR pulse from the scanner only blocks SS pulses until the E-IR pulse arrives.

All pulses from the unit to the scanner are negative-going (0 to -6 V), as in the SC pulse from the scanner. The E-IR pulse is positive-going.

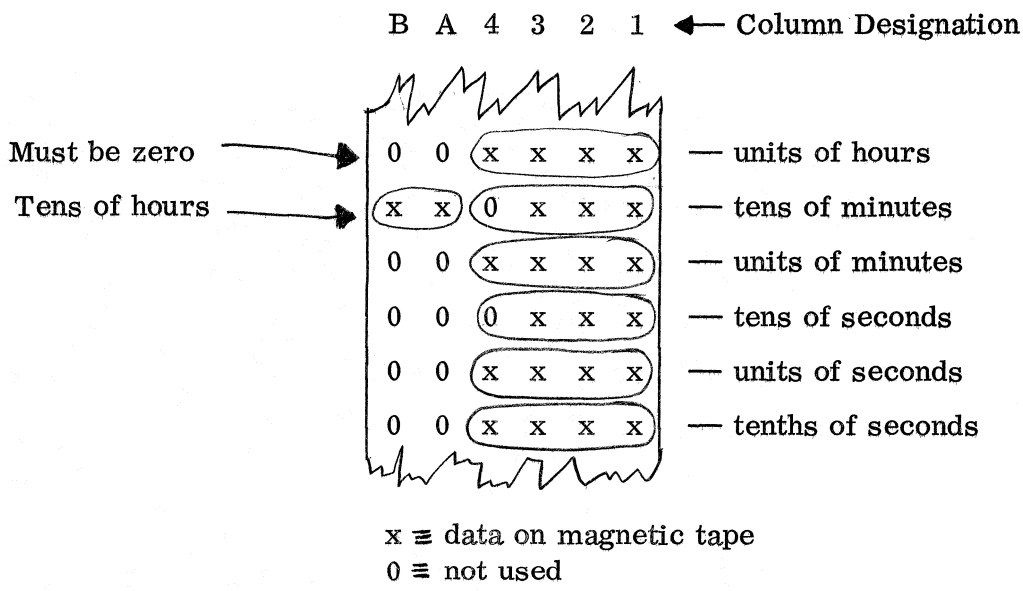

Figure I

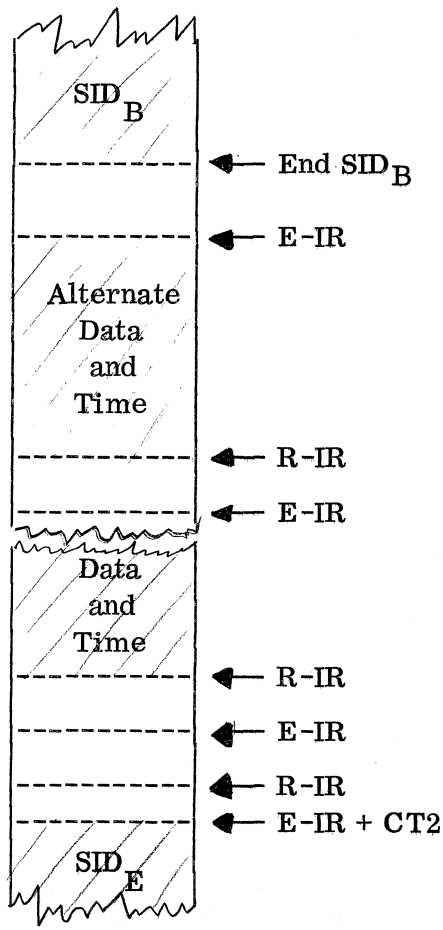

Figure II

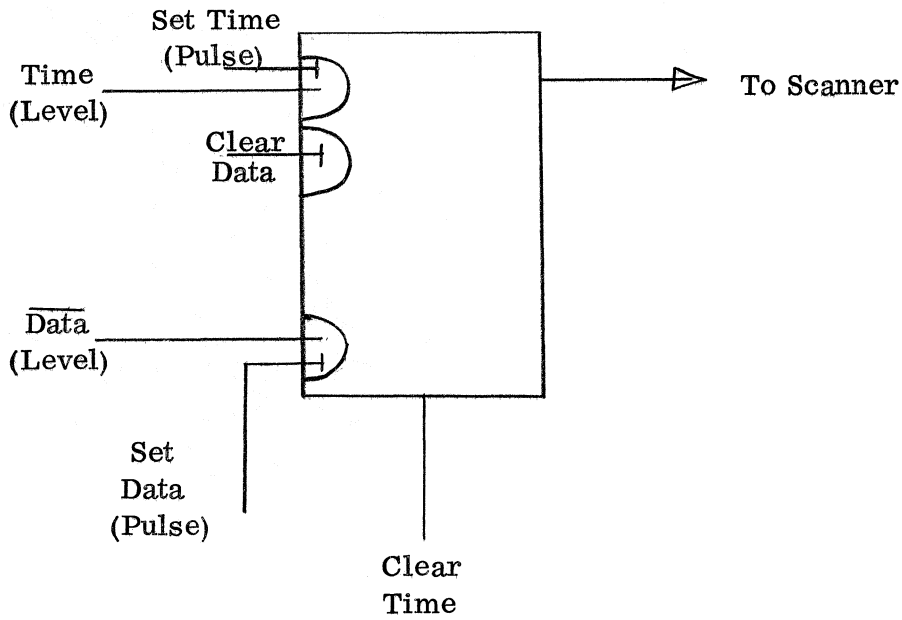
Set Time
(Pulse)
Time
(Level)
Clear
Data
To Scanner
Data
(Level)
Set
Data
(Pulse)
Clear
Time

Figure III